Semi-automatic creation of rock support class drawings

Continuous Excavation

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1 INTRODUCTION

RockSupport is a software based on Visual Studio, AutoCAD and Excel, offering an easy way to create rock support class drawings.

RockSupport includes the following functions:

- Continuous excavation for tunnels
  - Shotcrete
  - Rock bolts
  - Wire mesh
  - Steel ribs
  - Grouting

  Following items will be created on the drawing:
  - a cross section showing items listed above
  - a plan view or flat view of the cross section
  - Table showing items and corresponding values listed above including quantities per linear meter excavation
- excavation for tunnels and shafts (please see CYCLIC help)

A template drawing is used to define Linetypes, Text Style, Dimension Style, Multileader Style, LTScale, etc.. Layers defined in sheet SETTINGS, shall exist in the template drawing.

It is recommended to create and use different template drawings for different annotation scales.

The drawing created by the ***RockSupport*** software shall be copied into a final drawing manually, containing headers, notes, etc.

2 NOTATION

Values listed below can be used as variables to be inserted into text (see 4.3).

Value	Unit	Description
ABDL1	m	additionl anchor #1 at left distance from crown at area A1
ABDL9	m	additionl anchor #9 at left distance from crown at area A1
ABDR1	m	additionl anchor #1 at right distance from crown at area A1
ABDR9	m	additionl anchor #9 at right distance from crown at area A1
BBDL1	m	additionl anchor #1 at left distance from crown at area A2
BBDL9	m	additionl anchor #9 at left distance from crown at area A2
BBDR1	m	additionl anchor #1 at right distance from crown at area A2
BBDR9	m	additionl anchor #9 at right distance from crown at area A2
cGRT1		Grouting text for area A1
cGRT2		Grouting text for area A2
cRBT1		type of rock bplts at area A1
cRBT2		type of rock bplts at area A2
cSCC		scale for cross section (CANNOSCALE)
cSCD		scale for flat view
cSCQ1	m	shotcrete grade at area A1
cSCQ2	m	shotcrete grade at area A2
cSCT1	m	type of shotcrete at area A1
cSCT2	m	type of shotcrete at area A2
cSRT1		steel rib tipe at area A1
cSRT2		steel rib tipe at area A2
cTXT		Cross-section designation
cWM1T		area A1 - mountain side without steel ribs - type
cWM2T		area A1 - mountain side with steel ribs - type
cWM3T		area A1 - cavitiy side with steel ribs - type
cWM4T		area A2 - mountain side without steel ribs - type
cWM5T		area A2 - mountain side with steel ribs - type
cWM6T		area A2 - cavitiy side with steel ribs - type
DIST0	m	area A1 and A2 - rock bolts - perpendicular distance from the start of the stroke length
DIST1	m	area A1 - steel ribs - perpendicular distance from the start of the stroke length
EXC1	m	oversize tolerance
GRW1	kg/LM tunnel	grouting weight at area A1
GRW2	kg/LM tunnel	grouting weight at area A2
INV_AL1		angle for invert tubing at areas A1 and A2
INV_AL2		angle for invert tubing at areas A2 only
iRBD1	mm	area A1- rock bolt diameter
iRBD2	mm	area A2- rock bolt diameter
iRBFY1	N/mm²	area A1- yield strength of rock bolts
iRBFY2	N/mm²	area A2- yield strength of rock bolts
iRBN1		area A1- number of rock bolts
iRBN2		area A2 - number of rock bolts
iWM1N		Area A1 - mountain side without steel ribs - number of layers
iWM2N		Area A1 - mountain side with steel ribs - number of layers
iWM3N		Area A1 - cavity side with steel ribs - number of layers
iWM4N		Area A2 - mountain side without steel ribs - number of layers
iWM5N		Area A2 - mountain side with steel ribs - number of layers
iWM6N		Area A2 - cavity side with steel ribs - number of layers
LT1	m	thickness of inner lining
MAR1		allownace of tolerance

Figure 1: Notation, Part 1 of 2

Value	Unit	Description
R1	m	radius for clearance profile
RBL1	m	area A1 - rock bolt length
RBL2	m	area A2 - rock bolt length
RBN1_SH		area A1 - shifting of the ankers to the left or to the right
RBN2_SH		area A2- shifting of the ankers to the left or to the right
RBSL1	m	area A1 - rock bolt longitudinal spacing
RBSL2	m	area A2 - rock bolt longitudinal spacing
RBST1	m	area A1 - rock bolt transversal spacing
RBST2	m	area A2 - rock bolt transversal spacing
RL1	m	length of stroke
SCFG1	m3/round	area A1 - filling in gussets and oberbreak
SCFG2	m3/round	area A2 - filling in gussets and oberbreak
SCT1	m	area A1 - shotcrete thickness
SCT2	m	area A2 - shotcrete thickness
SRH1	mm	area A1 - steel ribs - profile section height
SRH2	mm	area A2 - steel ribs - profile section height
SRL1	m	area A1 - longitudinal spacing of steel ribs
SRLS1		area A1 - length of steel ribs
SRW1	mm	area A1 - steel ribs - profile section width
SRW2	mm	area A2 - steel ribs - profile section width
UT1	m	thickness of substrate preparation (separating foil, etc.)
UT2	m	excess of drilling diameter
UT3	m	overcut
WML1	m	area A1 - wire mesh total length
WML2	m	area A2 - wire mesh total length
XO	m	X-origin of cross section
YO1	m	Y-coordinate - cross section Area A1
YO2	m	Y-coordinate - cross section Area A2
YO3	m	Y-coordinate - Annotation for area A1+A2
YO4	m	Y-coordinate - Header line
YO5	m	Y-coordinate - Rockbolt pattern
YO6	m	Y-coordinate - Table
YO7	m	Y-coordinate - Summary

Figure 2: Notation, Part 2 of 2

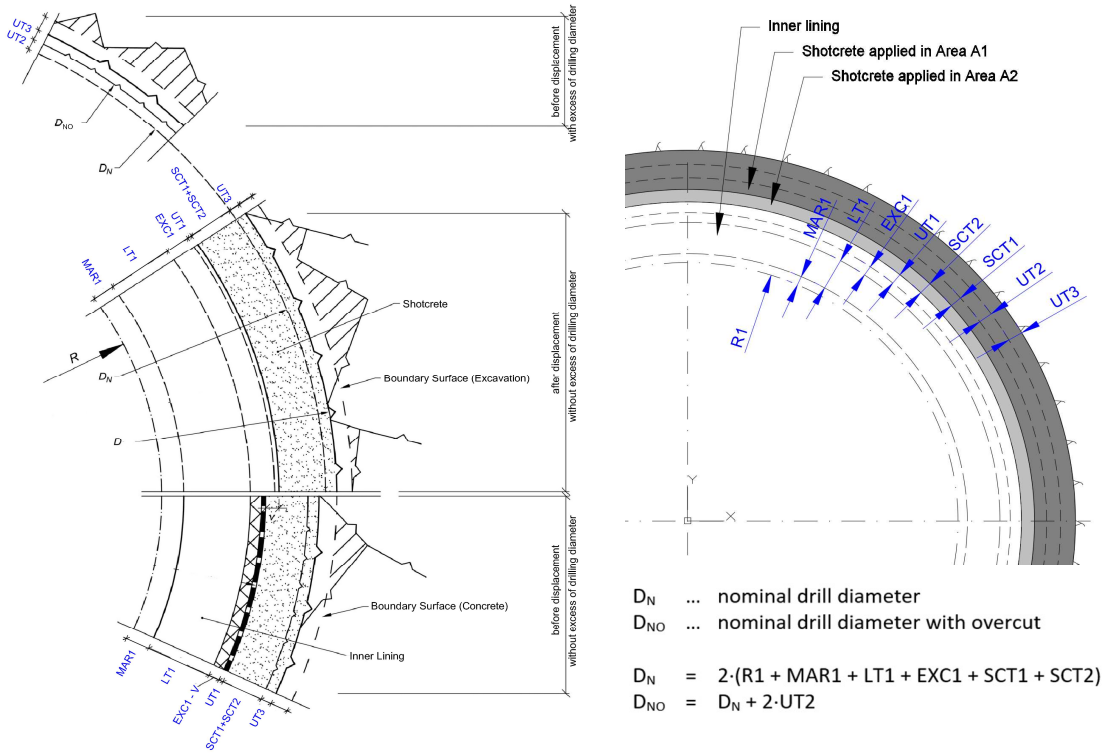


Figure 3: Notation - Cross section

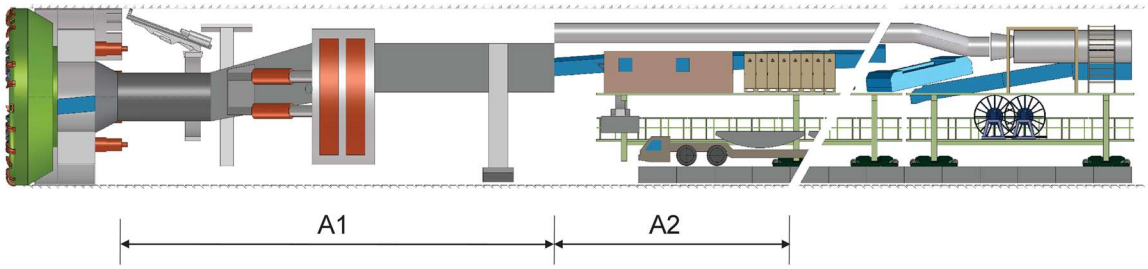


Figure 4: Notation - Areas A1 and A2

3 ROCKSUPPORT PROGRAM

In the MAIN menu the project folder and the sub-folders for input and output files shall be defined.

Figure 5: RockSupport program – Main menu

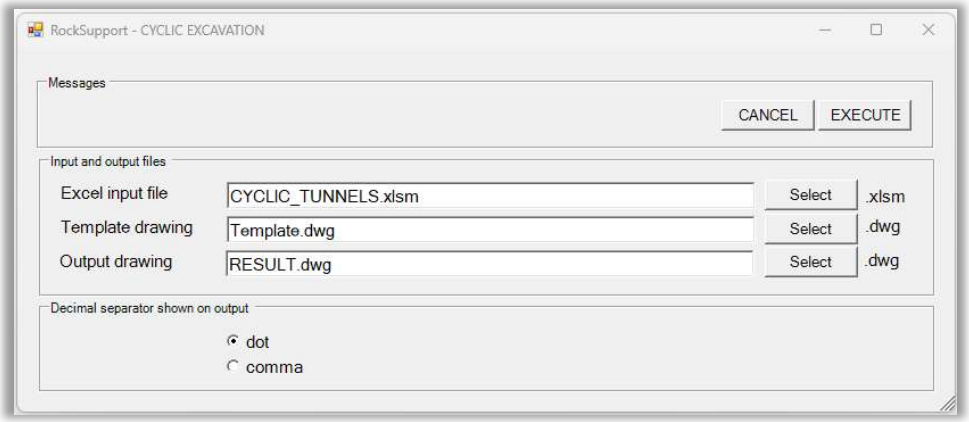


Figure 6: RockSupport program – Cyclic excavation sub-menu

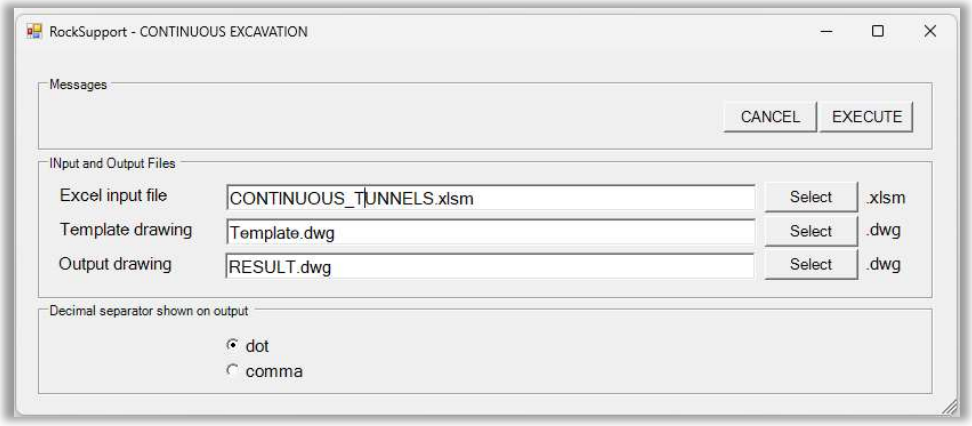


Figure 7: RockSupport program – Continuous excavaton sub-menu

4 INPUT FILE

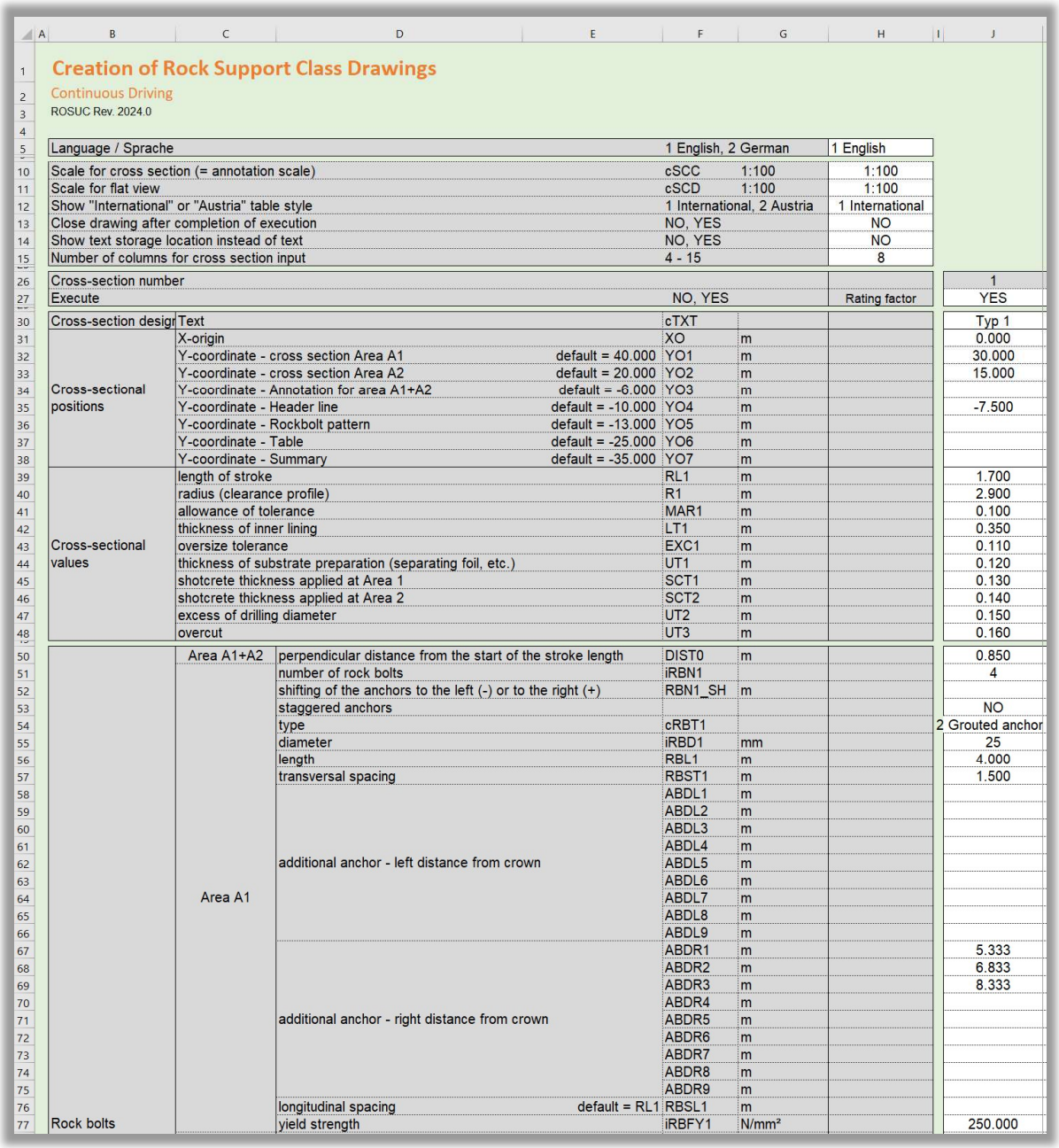
An EXCEL file (for example TBM.xlsm) defines the input values and settings for cyclic excavation. The name of this file can be freely chosen. However, the xlsm extension is to be retained.

This EXCEL file contains following sheets:

- MAIN_TBM
- SETTINGS
- TEXT
- DROP-DOWN
- MENU

4.1 MAIN_TBM sheet

These sheet is the principal input pages for continuous tunnel excavation.



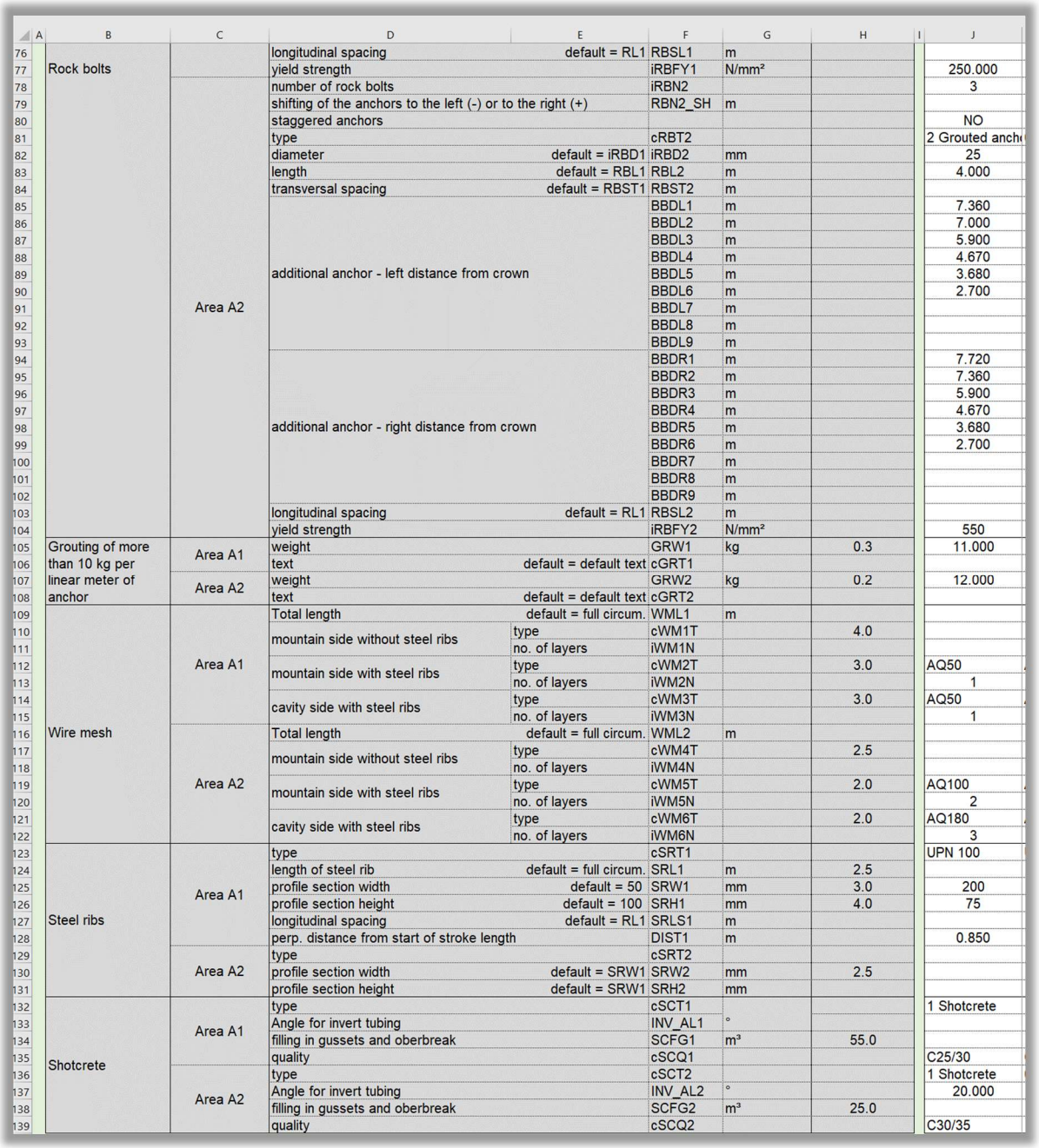
Creation of Rock Support Class Drawings

Continuous Driving

ROSUC Rev. 2024.0

Language / Sprache				1 English, 2 German		1 English	
Scale for cross section (= annotation scale)				cSCC	1:100	1:100	
Scale for flat view				cSCD	1:100	1:100	
Show "International" or "Austria" table style				1 International, 2 Austria		1 International	
Close drawing after completion of execution				NO, YES		NO	
Show text storage location instead of text				NO, YES		NO	
Number of columns for cross section input				4 - 15		8	
Cross-section number							1
Execute				NO, YES		Rating factor	YES
Cross-section design	Text			cTXT			Typ 1
Cross-sectional positions	X-origin			XO	m		0.000
	Y-coordinate - cross section Area A1		default = 40.000	YO1	m		30.000
	Y-coordinate - cross section Area A2		default = 20.000	YO2	m		15.000
	Y-coordinate - Annotation for area A1+A2		default = -6.000	YO3	m		
	Y-coordinate - Header line		default = -10.000	YO4	m		-7.500
	Y-coordinate - Rockbolt pattern		default = -13.000	YO5	m		
	Y-coordinate - Table		default = -25.000	YO6	m		
	Y-coordinate - Summary		default = -35.000	YO7	m		
Cross-sectional values	length of stroke			RL1	m		1.700
	radius (clearance profile)			R1	m		2.900
	allowance of tolerance			MAR1	m		0.100
	thickness of inner lining			LT1	m		0.350
	oversize tolerance			EXC1	m		0.110
	thickness of substrate preparation (separating foil, etc.)			UT1	m		0.120
	shotcrete thickness applied at Area 1			SCT1	m		0.130
	shotcrete thickness applied at Area 2			SCT2	m		0.140
	excess of drilling diameter			UT2	m		0.150
	overcut			UT3	m		0.160
	Area A1+A2	perpendicular distance from the start of the stroke length		DIST0	m		0.850
		number of rock bolts		iRBN1			4
		shifting of the anchors to the left (-) or to the right (+)		RBN1_SH	m		
		staggered anchors					NO
		type		cRBT1			2 Grouted anchor
		diameter		iRBD1	mm		25
		length		RBL1	m		4.000
		transversal spacing		RBST1	m		1.500
	Area A1	additional anchor - left distance from crown		ABDL1	m		
				ABDL2	m		
				ABDL3	m		
				ABDL4	m		
				ABDL5	m		
				ABDL6	m		
				ABDL7	m		
				ABDL8	m		
				ABDL9	m		
		additional anchor - right distance from crown		ABDR1	m		5.333
				ABDR2	m		6.833
				ABDR3	m		8.333
				ABDR4	m		
				ABDR5	m		
				ABDR6	m		
				ABDR7	m		
				ABDR8	m		
				ABDR9	m		
		longitudinal spacing	default = RL1	RBSL1	m		
Rock bolts		yield strength		iRBFY1	N/mm²		250.000

Figure 8: MAIN_TBM sheet, Upper portion



	B	C	D	E	F	G	H	J
76	Rock bolts		longitudinal spacing	default = RL1	RBSL1	m		
77			yield strength		iRBFY1	N/mm²		250.000
78			number of rock bolts		iRBN2			3
79			shifting of the anchors to the left (-) or to the right (+)		RBN2_SH	m		
80			staggered anchors					NO
81			type		cRBT2			2 Grouted anch
82			diameter	default = iRBD1	iRBD2	mm		25
83			length	default = RBL1	RBL2	m		4.000
84			transversal spacing	default = RBST1	RBST2	m		
85			additional anchor - left distance from crown		BBDL1	m		7.360
86					BBDL2	m		7.000
87					BBDL3	m		5.900
88					BBDL4	m		4.670
89					BBDL5	m		3.680
90					BBDL6	m		2.700
91		Area A2			BBDL7	m		
92					BBDL8	m		
93					BBDL9	m		
94			additional anchor - right distance from crown		BBDR1	m		7.720
95					BBDR2	m		7.360
96					BBDR3	m		5.900
97					BBDR4	m		4.670
98					BBDR5	m		3.680
99					BBDR6	m		2.700
100					BBDR7	m		
101					BBDR8	m		
102					BBDR9	m		
103			longitudinal spacing	default = RL1	RBSL2	m		
104			yield strength		iRBFY2	N/mm²		550
105	Grouting of more than 10 kg per linear meter of anchor	Area A1	weight		GRW1	kg	0.3	11.000
106			text	default = default text	cGRT1			
107		Area A2	weight		GRW2	kg	0.2	12.000
108			text	default = default text	cGRT2			
109	Wire mesh	Area A1	Total length	default = full circum.	WML1	m		
110			mountain side without steel ribs	type	cWM1T		4.0	
111				no. of layers	iWM1N			
112			mountain side with steel ribs	type	cWM2T		3.0	AQ50
113				no. of layers	iWM2N			1
114			cavity side with steel ribs	type	cWM3T		3.0	AQ50
115				no. of layers	iWM3N			1
116		Area A2	Total length	default = full circum.	WML2	m		
117			mountain side without steel ribs	type	cWM4T		2.5	
118				no. of layers	iWM4N			
119			mountain side with steel ribs	type	cWM5T		2.0	AQ100
120				no. of layers	iWM5N			2
121			cavity side with steel ribs	type	cWM6T		2.0	AQ180
122				no. of layers	iWM6N			3
123	Steel ribs	Area A1	type		cSRT1			UPN 100
124			length of steel rib	default = full circum.	SRL1	m	2.5	
125			profile section width	default = 50	SRW1	mm	3.0	200
126			profile section height	default = 100	SRH1	mm	4.0	75
127			longitudinal spacing	default = RL1	SRLS1	m		
128			perp. distance from start of stroke length		DIST1	m		0.850
129		Area A2	type		cSRT2			
130			profile section width	default = SRW1	SRW2	mm	2.5	
131			profile section height	default = SRW1	SRH2	mm		
132	Shotcrete	Area A1	type		cSCT1			1 Shotcrete
133			Angle for invert tubing		INV_AL1	°		
134			filling in gussets and oberbreak		SCFG1	m³	55.0	
135			quality		cSCQ1			C25/30
136		Area A2	type		cSCT2			1 Shotcrete
137			Angle for invert tubing		INV_AL2	°		20.000
138			filling in gussets and oberbreak		SCFG2	m³	25.0	
139			quality		cSCQ2			C30/35

Figure 9: MAIN_TBM sheet, Lower portion

4.1.1 *Language and drawing scale*

Language / Sprache	1 English, 2 German	1 English
Scale for cross section and plan view (= annotation scale)	cSCC 1:100	1:100
Scale for flat view	cSCD 1:100	1:100
Show "International" or "Austria" table style	1 International, 2 Austria	1 International
Close drawing after completion of execution	NO, YES	NO
Show text storage location instead of text	NO, YES	NO
Number of columns for cross section input	4 - 15	8

Figure 10: EXCEL input - Language and drawing scale - English

Sprache / Language	1 English, 2 German	2 German
Maßstab für Querschnitt und Grundriss (= CANNOSCALE)	cSCC 1:100	1:100
Maßstab für Abwicklung	cSCD 1:100	1:100
"Internationale" Tabelle oder "ÖNorm" Tabelle darstellen	1 International, 2 Austria	1 International
Zeichnung nach Beendigung der Erstellung schließen	NO, YES	NO
Text-Speicherort anstatt des Textes anzeigen	NO, YES	NO
Anzahl Spalten für Querschnittseingabe	4 - 15	8

Figure 11: EXCEL input - Language and drawing scale – German

4.1.2 *X and Y origins cross sections, rock bolt pattern, tables and summary info*

Überschrift	Text		cTXT			Typ 1
Cross-sectional positions	X-origin		XO	m		0.000
	Y-coordinate - cross section Area A1	default = 40.000	YO1	m		30.000
	Y-coordinate - cross section Area A2	default = 20.000	YO2	m		15.000
	Y-coordinate - Annotation for area A1+A2	default = -6.000	YO3	m		
	Y-coordinate - Header line	default = -10.000	YO4	m		-7.500
	Y-coordinate - Rockbolt pattern	default = -13.000	YO5	m		
	Y-coordinate - Table	default = -25.000	YO6	m		
	Y-coordinate - Summary	default = -35.000	YO7	m		

Figure 12: EXCEL input - X and Y-origins of cross sections, designation text, rock bolt pattern, tables and summary values

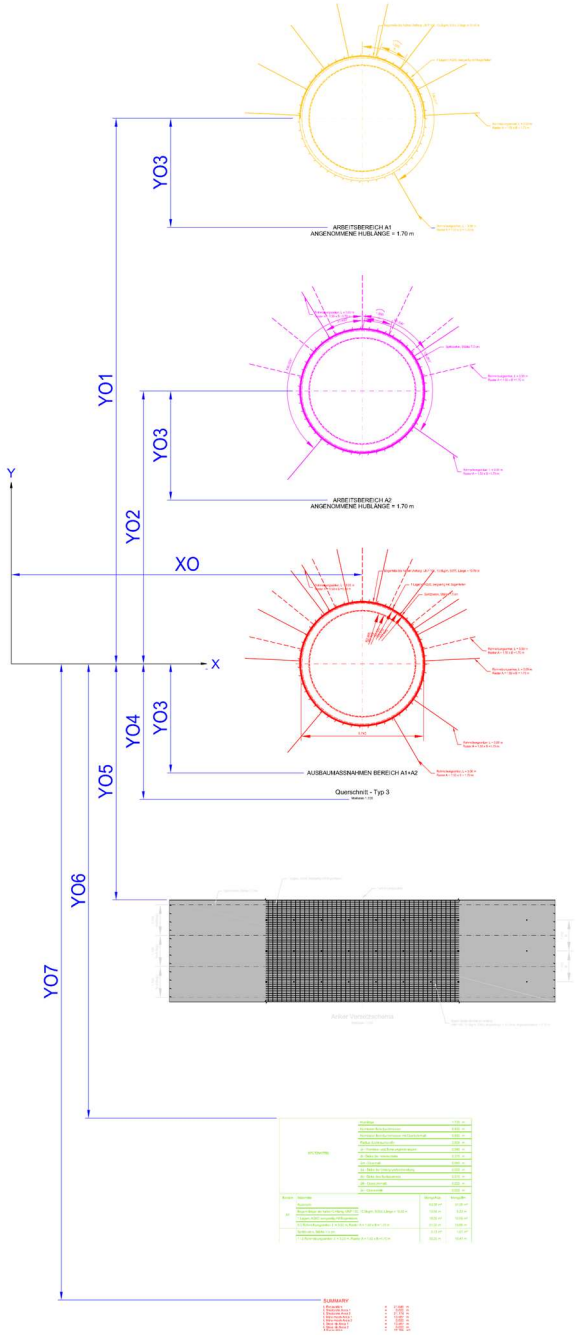


Figure 13: Standard layout on drawing

4.1.3 *Definition of cross section and shotcrete*

Querschnittswerte	length of stroke	RL1	m		1.700
	radius (clearance profile)	R1	m		2.900
	üt - allowance of tolerance	MAR1	m		0.100
	di - thickness of inner lining	LT1	m		0.350
	üm - oversize tolerance	EXC1	m		0.110
	da - thickness of substrate preparation (separating foil, etc.)	UT1	m		0.120
	ds1 - shotcrete thickness applied at Area 1	SCT1	m		0.130
	ds2 - shotcrete thickness applied at Area 2	SCT2	m		0.140
	üB - excess of drilling diameter	UT2	m		0.150
	üS -- overcut	UT3	m		0.160

Figure 14: EXCEL input – Definition of cross section - German

Cross-sectional values	length of stroke	RL1	m		1.700
	radius (clearance profile)	R1	m		2.900
	allowance of tolerance	MAR1	m		0.100
	thickness of inner lining	LT1	m		0.350
	oversize tolerance	EXC1	m		0.110
	thickness of substrate preparation (separating foil, etc.)	UT1	m		0.120
	shotcrete thickness applied at Area 1	SCT1	m		0.130
	shotcrete thickness applied at Area 2	SCT2	m		0.140
	excess of drilling diameter	UT2	m		0.150
	overcut	UT3	m		0.160

Figure 15: EXCEL input – Definition of cross section – English

Shotcrete	Area A1	type	cSCT1			1 Shotcrete
		Angle for invert tubing	INV_AL1	°		
		filling in gussets and oberbreak	SCFG1	m³	55.0	
		quality	cSCQ1			C25/30
	Area A2	type	cSCT2			1 Shotcrete
		Angle for invert tubing	INV_AL2	°		
		filling in gussets and oberbreak	SCFG2	m³	25.0	
		quality	cSCQ2			C30/35

Figure 16: EXCEL input – Shotcrete with no tubing

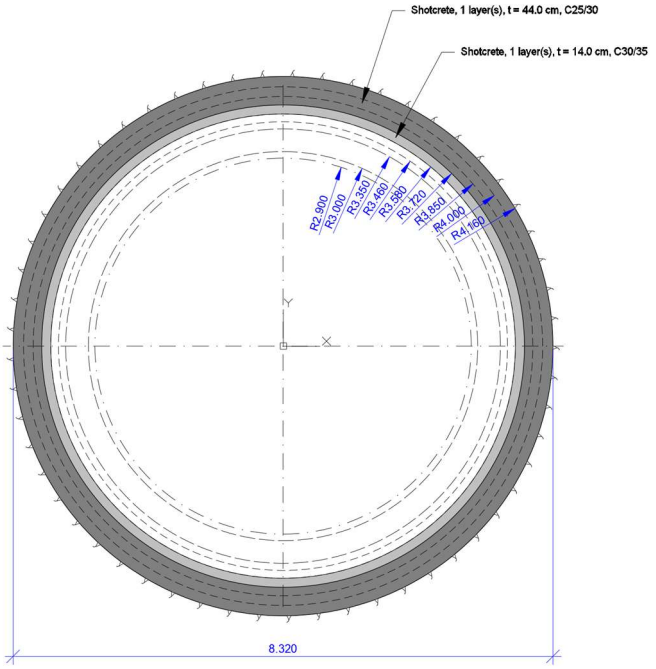


Figure 17: Cross section output on drawing – Shotcrete with no tubing

ROCK SUPPORT	Stroke length	1.700 m
	Nominal drill diameter	7.700 m
	Nominal drill diameter with overcut	8.000 m
	Radius (clearance profile)	2.900 m
	Allowance of tolerance (MAR1)	0.100 m
	Thickness of inner lining (LT1)	0.350 m
	Oversize tolerance (EXC1)	0.110 m
	Thickness of substrate preparation (UT1)	0.120 m
	Shotcrete thickness (SCT1+SCT2)	0.270 m
	Excess of drilling diameter (UT2)	0.150 m
	Overcut (UT3)	0.160 m

Area	Support Measure	Quant/stroke	Quant/LM
A1	Excavation	92.42 m³	54.37 m³
	Shotcrete, 1 layer(s), t = 44.0 cm, C25/30	18.52 m³	10.89 m³
	Shotcrete, 1 layer(s), t = 14.0 cm, C30/35	5.46 m³	3.21 m³

Figure 18: Table output on drawing – Shotcrete

Shotcrete	Area A1	type	cSCT1			1 Shotcrete
		Angle for invert tubing	INV_AL1	°		
		filling in gussets and oberbreak	SCFG1	m³	55.0	
		quality	cSCQ1			C25/30
	Area A2	type	cSCT2			1 Shotcrete
		Angle for invert tubing	INV_AL2	°		30.000
		filling in gussets and oberbreak	SCFG2	m³	25.0	
		quality	cSCQ2			C30/35

Figure 19: EXCEL input – Shotcrete with invert tubing only in shotcrete SCT2

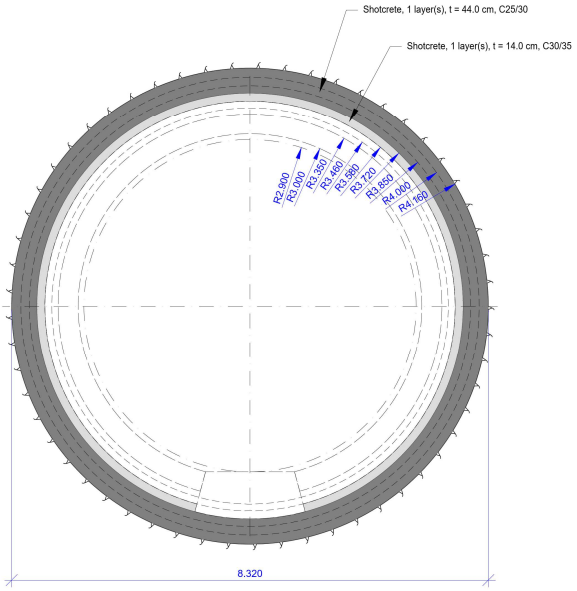


Figure 20: Cross section output on drawing – Shotcrete with invert tubing only in shotcrete SCT2

Shotcrete	Area A1	type	cSCT1			1 Shotcrete
		Angle for invert tubing	INV_AL1	°		30.000
		filling in gussets and oberbreak	SCFG1	m³	55.0	
		quality	cSCQ1			C25/30
	Area A2	type	cSCT2			1 Shotcrete
		Angle for invert tubing	INV_AL2	°		
		filling in gussets and oberbreak	SCFG2	m³	25.0	
		quality	cSCQ2			C30/35

Figure 21: EXCEL input – Shotcrete with invert tubing in shotcrete SCT1 and SCT2

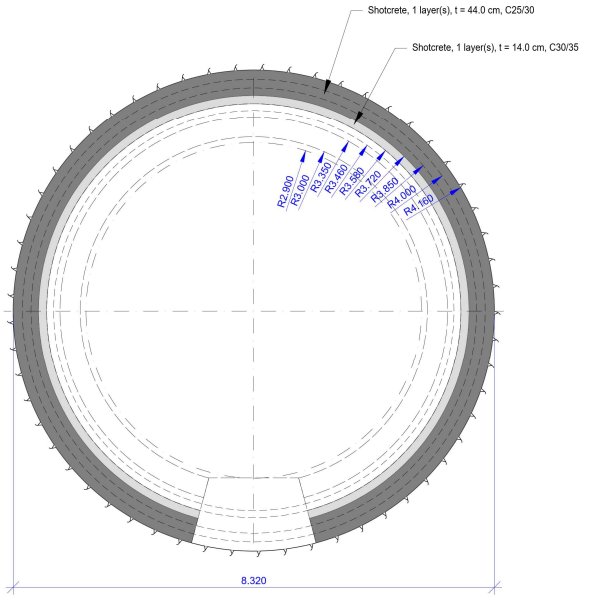


Figure 22: Cross section output on drawing – Shotcrete with invert tubing in shotcrete SCT1 and SCT2

4.1.4 Definition of wiremesh and steel ribs

Wire mesh	Area A1	Total length	default = full circum.	WML1	m		
		mountain side without steel ribs	type	cWM1T		4.0	
			no. of layers	iWM1N			
		mountain side with steel ribs	type	cWM2T		3.0	AQ50
			no. of layers	iWM2N			1
		cavity side with steel ribs	type	cWM3T		3.0	AQ50
			no. of layers	iWM3N			1
	Area A2	Total length	default = full circum.	WML2	m		
		mountain side without steel ribs	type	cWM4T		2.5	
			no. of layers	iWM4N			
		mountain side with steel ribs	type	cWM5T		2.0	AQ100
			no. of layers	iWM5N			2
		cavity side with steel ribs	type	cWM6T		2.0	AQ180
			no. of layers	iWM6N			3
Steel ribs	Area A1	type		cSRT1			UPN 100
		length of steel rib	default = full circum.	SRL1	m	2.5	
		profile section width	default = 50	SRW1	mm	3.0	200
		profile section height	default = 100	SRH1	mm	4.0	75
		longitudinal spacing	default = RL1	SRLS1	m		
		perp. distance from start of stroke length		DIST1	m		0.850
	Area A2	type		cSRT2			
		profile section width	default = SRW1	SRW2	mm	2.5	
		profile section height	default = SRW1	SRH2	mm		

Figure 23: EXCEL input – Wire mesh and steel ribes

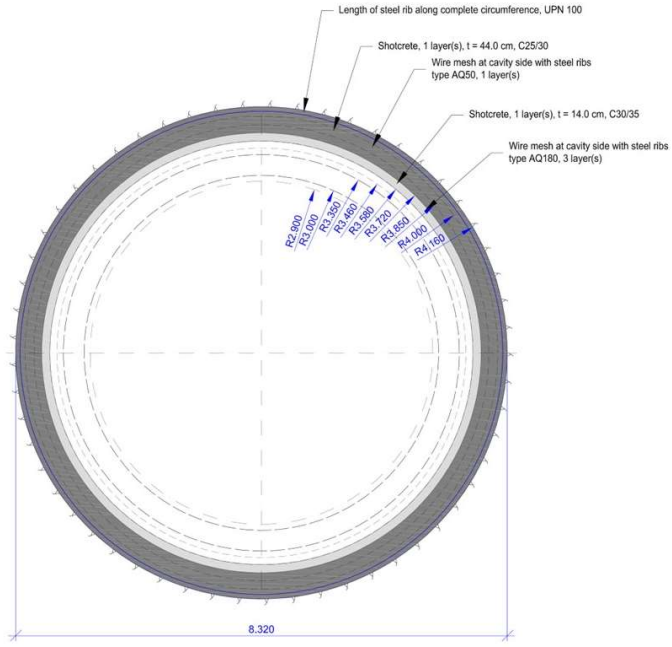


Figure 24: Cross section output on drawing – Wire mesh and steel ribes

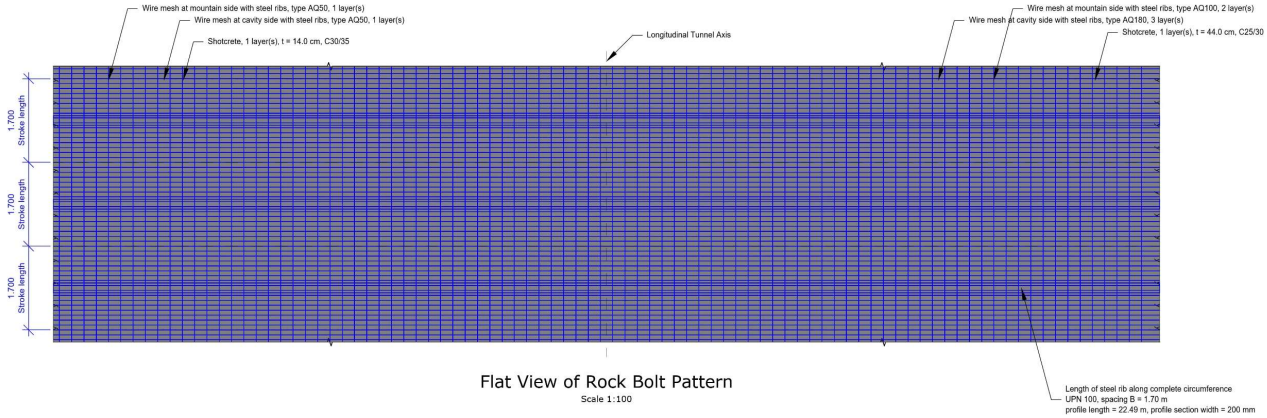


Figure 25: Plan view output on drawing – Wire mesh and steel ribes

ROCK SUPPORT	Stroke length	1.700 m
	Nominal drill diameter	7.700 m
	Nominal drill diameter with overcut	8.000 m
	Radius (clearance profile)	2.900 m
	Allowance of tolerance (MAR1)	0.100 m
	Thickness of inner lining (LT1)	0.350 m
	Oversize tolerance (EXC1)	0.110 m
	Thickness of substrate preparation (UT1)	0.120 m
	Shotcrete thickness (SCT1+SCT2)	0.270 m
	Excess of drilling diameter (UT2)	0.150 m
	Overcut (UT3)	0.160 m

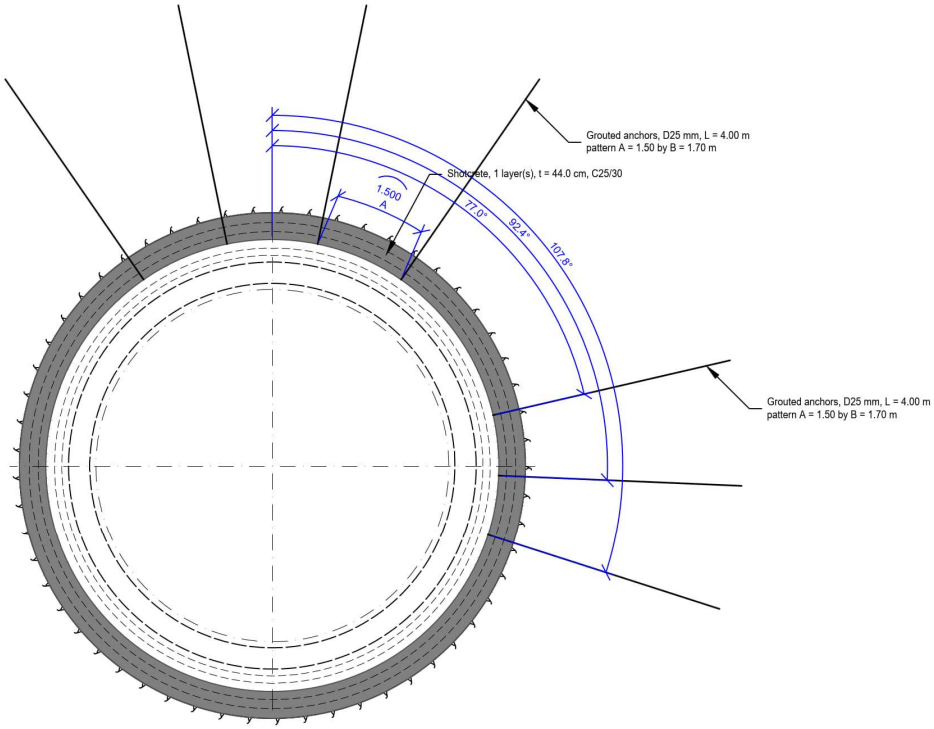
Area	Support Measure	Quant/stroke	Quant/LM
A1	Excavation	92.42 m³	54.37 m³
	Length of steel rib along complete circumference, UPN 100	22.49 m	13.23 m
	Wire mesh at mountain side with steel ribs, type AQ50, 1 layer(s) Wire mesh at cavity side with steel ribs, type AQ50, 1 layer(s)	38.24 m² 38.24 m²	22.49 m² 22.49 m²
	Shotcrete, 1 layer(s), t = 44.0 cm, C25/30	18.52 m³	10.89 m³
A2	Wire mesh at mountain side with steel ribs, type AQ100, 2 layer(s) Wire mesh at cavity side with steel ribs, type AQ180, 3 layer(s)	76.48 m² 114.72 m²	44.99 m² 67.48 m²
	Shotcrete, 1 layer(s), t = 14.0 cm, C30/35	5.46 m³	3.21 m³

Figure 26: Table output on drawing – Wire mesh and steel ribes

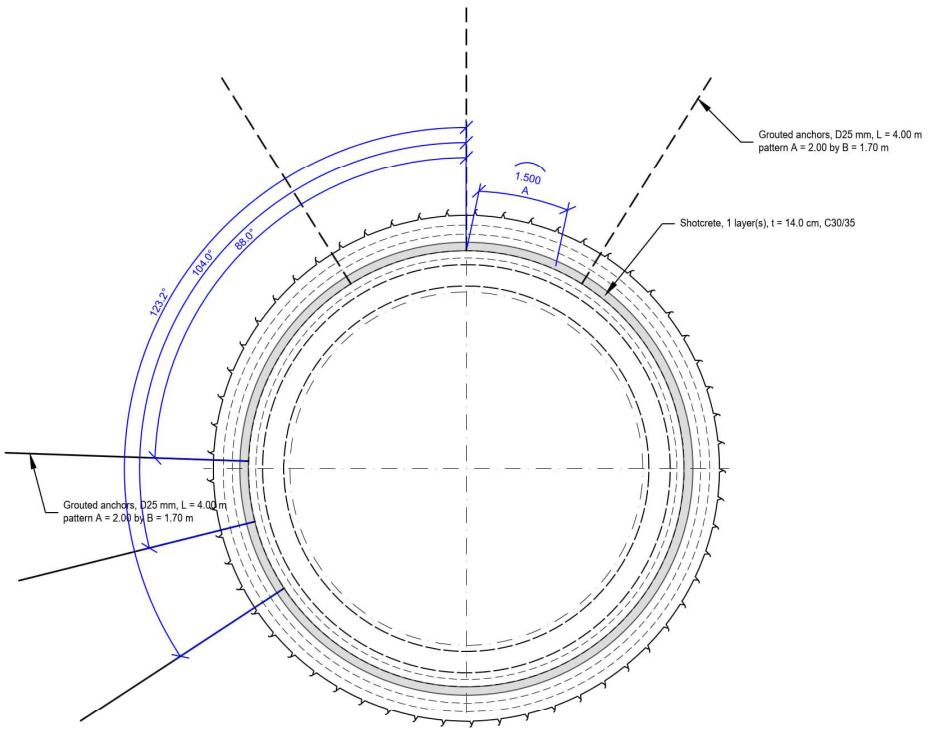
4.1.5 *Definition of rockbolts*

	Area A1+A2	perpendicular distance from the start of the stroke length	DIST0	m		0.850
		number of rock bolts	iRBN1			4
		shifting of the anchors to the left (-) or to the right (+)	RBN1_SH	m		
		staggered anchors				NO
		type	cRBT1			2 Grouted anchor
		diameter	iRBD1	mm		25
		length	RBL1	m		4.000
		transversal spacing	RBST1	m		1.500
			ABDL1	m		
			ABDL2	m		
			ABDL3	m		
			ABDL4	m		
		additional anchor - left distance from crown	ABDL5	m		
			ABDL6	m		
	Area A1		ABDL7	m		
			ABDL8	m		
			ABDL9	m		
			ABDR1	m		5.333
			ABDR2	m		6.833
			ABDR3	m		8.333
			ABDR4	m		
		additional anchor - right distance from crown	ABDR5	m		
			ABDR6	m		
			ABDR7	m		
			ABDR8	m		
			ABDR9	m		
		longitudinal spacing default = RL1	RBSL1	m		
Rock bolts		yield strength	iRBFY1	N/mm²		250.000
		number of rock bolts	iRBN2			3
		shifting of the anchors to the left (-) or to the right (+)	RBN2_SH	m		
		staggered anchors				NO
		type	cRBT2			2 Grouted ancho
		diameter default = iRBD1	iRBD2	mm		25
		length default = RBL1	RBL2	m		4.000
		transversal spacing default = RBST1	RBST2	m		
			BBDL1	m		7.360
			BBDL2	m		7.000
			BBDL3	m		5.900
			BBDL4	m		4.670
		additional anchor - left distance from crown	BBDL5	m		3.680
			BBDL6	m		2.700
	Area A2		BBDL7	m		
			BBDL8	m		
			BBDL9	m		
			BBDR1	m		7.720
			BBDR2	m		7.360
			BBDR3	m		5.900
			BBDR4	m		4.670
		additional anchor - right distance from crown	BBDR5	m		3.680
			BBDR6	m		2.700
			BBDR7	m		
			BBDR8	m		
			BBDR9	m		
		longitudinal spacing default = RL1	RBSL2	m		
		yield strength	iRBFY2	N/mm²		550

Figure 27: EXCEL input – Rockbolts



WORKSPACE A1
ESTIMATED LENGTH OF STROKE = 1.70 m



WORKSPACE A2
ESTIMATED LENGTH OF STROKE = 1.70 m

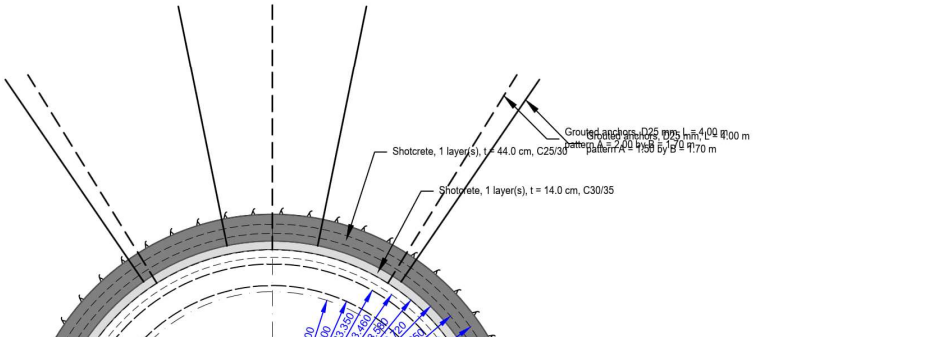


Figure 28: Cross section output on drawing – Rockbolts

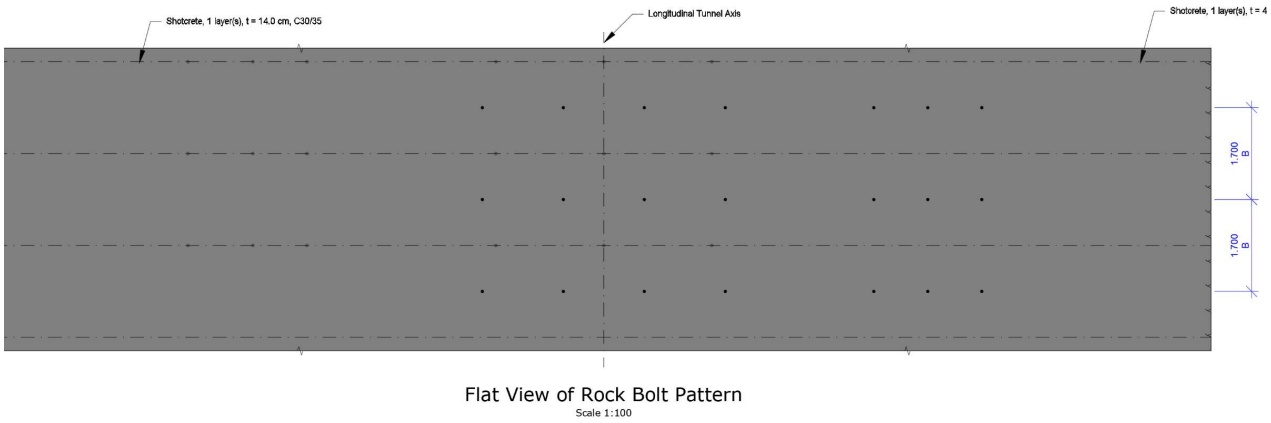


Figure 29: Plan view output on drawing – Rockbolts

ROCK SUPPORT	Stroke length	1.700 m
	Nominal drill diameter	7.700 m
	Nominal drill diameter with overcut	8.000 m
	Radius (clearance profile)	2.900 m
	Allowance of tolerance (MAR1)	0.100 m
	Thickness of inner lining (LT1)	0.350 m
	Oversize tolerance (EXC1)	0.110 m
	Thickness of substrate preparation (UT1)	0.120 m
	Shotcrete thickness (SCT1+SCT2)	0.270 m
	Excess of drilling diameter (UT2)	0.150 m
	Overcut (UT3)	0.160 m

Area	Support Measure	Quant/stroke	Quant/LM
A1	Excavation	92.42 m³	54.37 m³
	Shotcrete, 1 layer(s), t = 44.0 cm, C25/30	18.52 m³	10.89 m³
	7.0 Grouted anchors, D25 mm, L = 4.00 m, pattern A = 1.50 by B = 1.70 m	28.00 m	16.47 m
	Shotcrete, 1 layer(s), t = 14.0 cm, C30/35	5.46 m³	3.21 m³
	6.0 Grouted anchors, D25 mm, L = 4.00 m, pattern A = 2.00 by B = 1.70 m	24.00 m	14.12 m

Figure 30: Table output on drawing – Rockbolts

SUMMARY

L Excavation	=	26.138	m
L Shotcrete Area 1	=	23.373	m
L Shotcrete Area 2	=	22.494	m
L Wire mesh Area 1	=	0.000	m
L Wire mesh Area 2	=	0.000	m
L Steel rib Area 1	=	0.000	m
L Steel rib Area 2	=	0.000	m
A Excavation	=	54.367	m2
A Shotctete Area 1	=	10.893	m2
A Shotcrete Area 2	=	3.211	m2
Rockbolts at Area A1	=	7.0	pcs
Rockbolts at Area A2	=	6.0	pcs

Figure 31: Summary output on drawing

4.1.6 *Definition of grouoting*

Grouting of more than 10 kg per linear meter of anchor	Area A1	weight	GRW1	kg	0.3	11.000
		text default = default text	cGRT1			
	Area A2	weight	GRW2	kg	0.2	12.000
		text default = default text	cGRT2			

Figure 32: EXCEL input – Grouting

ROCK SUPPORT	Stroke length	1.700 m
	Nominal drill diameter	7.700 m
	Nominal drill diameter with overcut	8.000 m
	Radius (clearance profile)	2.900 m
	Allowance of tolerance (MAR1)	0.100 m
	Thickness of inner lining (LT1)	0.350 m
	Oversize tolerance (EXC1)	0.110 m
	Thickness of substrate preparation (UT1)	0.120 m
	Shotcrete thickness (SCT1+SCT2)	0.270 m
	Excess of drilling diameter (UT2)	0.150 m
	Overcut (UT3)	0.160 m

Area	Support Measure	Quant/stroke	Quant/LM
A1	Excavation	92.42 m³	54.37 m³
	Shotcrete, 1 layer(s), t = 44.0 cm, C25/30	18.52 m³	10.89 m³
	Grouting beyond 10 kg per linear meter of anchors at area A1 11.00 kg/LM tunnel	18.70 kg	11.00 kg
	Shotcrete, 1 layer(s), t = 14.0 cm, C30/35	5.46 m³	3.21 m³
	Grouting beyond 10 kg per linear meter of anchors at area A2 12.00 kg/LM tunnel	20.40 kg	12.00 kg

Figure 33: Table output on drawing – Grouting

4.2 SETTING sheet

Default values such as:

- Layer names to be used in the templated drawing
- Hatch colors
- Vertical location of plan view, tables etc. on drawings
- Default values for steel ribs and wire mesh
- Text sizes
- Table column width

can be amended on this sheet

4.3 TEXT sheet

Standard text in English and German is defined on the TEXT sheet for the labeling of cross-sections and tables. The standard text can be adapted to suit the specific project. However, no rows or columns may be inserted or deleted.

The variables shown in Figure 1 can be inserted according to following rules:

For example using the values taken from **Error! Reference source not found.**

cWM1T = AQ50 … area A1, mountain side without steel ribs, wire mesh type
iWM1N = 2 … area A1, mountain side without steel ribs, number of layers

and following text (see for example sheet TEXT, cell B340)

Wire mesh at mountain side without steel ribs\type #cWM1T#, #iWM1N# layer(s)

will results in

Wire mesh at mountain side without steel ribs
type AQ50, 2 layer(s)

to be plotted on drawing based on notation shown below:

%%c … Autocad notation for Ø symbol
\ … a backslash causes a line break
#iRBD1# … variables enclosed on both sides with # can be imported into text.
- a variable starting with lower case i is deemed to be an integer value
- a variable starting with lower case c is deemed to be a charcter string (text)
- all other variables are deemed to be of type real value with default format “0.00” (2 decimal places).

#RBL1# … real value with default format “0.00”.
#RBL1:0.000# … real value with format “0.000”

If a variable referres to a drop down menu like cRBT1, then the corresponding text is defined on the MAIN_CYCLIC sheet.

4.4 DROP-DOWN sheet

This sheet defines the dropdown menu for the support measures such as rock bolts and steel rib types in English or German.

4.5 MENU sheet

The text (English or German) displayed on the MAIN_TBM sheet is defined on the MENU sheet.